

Bitcoin as a False Safe-Haven Asset: A Valuation Analysis of the Economic Terminal Horizon and Network Uncertainty After 2140

Abstract

This paper argues that Bitcoin cannot be considered a safe-haven asset in a strict sense, due to a structural weakness in its long-term economic design. As a non-productive asset, its present value depends solely on its expected resale value in the future. However, the disappearance of the block subsidy around 2140 and the absence of any guaranteed mechanism to finance network security introduce a non-negligible probability of future collapse. By incorporating this probability into a standard discounted-cash-flow framework, and considering the feedback between collapse probability, volatility, and risk premium, the paper shows that Bitcoin's fundamental value as a supposed safe haven is inconsistent with the requirement of near-zero risk that defines this type of asset.

1. Introduction

Since its creation, Bitcoin has been described by its advocates as "digital gold" and, by extension, as a potential safe-haven asset against inflation, financial instability, or the risks inherent in state monetary systems. This narrative rests on two pillars: programmed scarcity and decentralization.

However, beyond rhetoric, any asset that aspires to be a safe haven must satisfy a basic condition: its future value, over long horizons, must be exposed to an extremely low probability of collapse. This paper argues that, in the case of Bitcoin, this condition is not met, due to:

1. Its nature as a non-productive asset (with no cash flows).
2. The existence of an economic terminal horizon linked to the disappearance of the block subsidy in 2140.
3. Structural uncertainty about the ability of the fee system to sustain network security beyond that point.
4. A mechanism of unstable feedback between perceived collapse probability, volatility, and the discount rate required by the market.

Starting from these premises, the paper develops a simple valuation framework showing how a non-zero probability of collapse, applied over a long horizon and with no intermediate cash flows, erodes the logic of Bitcoin as a safe-haven asset and empirically reinforces its character as a high-risk speculative asset.

2. Non-Productive Assets and the Concept of a Safe-Haven Asset

2.1 Productive vs. Non-Productive Assets

In standard financial theory, the current price of an asset can be expressed as the expected present value of its future cash flows:

$$P_0 = E[\sum (C_t / (1 + r)^t) + P_T / (1 + r)^T],$$

where:

- P_0 : price today,
- C_t : cash flows (dividends, coupons, rents, etc.) in period t ,
- P_T : resale price at horizon T ,
- r : discount rate (risk-free rate + risk premium),
- $E[\cdot]$: expectation operator.

In a productive asset (equities, bonds, real estate), a significant part of the value comes from the C_t . By contrast, Bitcoin:

- does not generate dividends,
- does not pay coupons,
- has no relevant physical or industrial use,
- does not provide cash flows to the holder.

Therefore, for Bitcoin we can write, in simplified form, $C_t = 0$ for all t , and the expression reduces to:

$$P_0 = E[P_T / (1 + r)^T].$$

In other words, its current value depends solely on how much someone is expected to pay for it in the future.

2.2 What Is a Safe-Haven Asset?

A safe-haven asset is not merely an asset that might appreciate in price; it is an asset that:

1. Preserves value over long horizons and in adverse scenarios.
2. Is exposed to a probability of collapse $P(P_T \approx 0)$ that is extremely close to zero.
3. Maintains a stable functionality (liquidity, security, acceptance) over time.

For long horizons T this means that:

- the probability that $P_T \approx 0$ is negligible;
- the distribution of P_T is concentrated on positive values, so that the expectation $E[P_T]$ is robust.

In the case of Bitcoin, it is precisely the shape of the distribution of P_T – and in particular the probability of collapse – that becomes problematic.

3. Bitcoin's Design and the 2140 Horizon

3.1 Block Subsidy and Network Security

Bitcoin's security is based on proof of work, which requires miners to invest resources (energy, hardware) to validate blocks. In return, they receive:

1. A block subsidy (newly issued bitcoins).
2. The transaction fees included in that block.

Over time, the protocol programmatically reduces the subsidy (via halvings), until it reaches zero around 2140. From that point on, the only source of revenue for miners will be transaction fees.

Here we encounter the first structural fragility: there is currently no guaranteed mechanism ensuring that future fees will be sufficient, in level and stability, to sustain a hashrate that keeps the network secure against attacks.

3.2 Economic Terminal Horizon

Although the Bitcoin protocol does not literally expire in 2140, from an economic standpoint this date marks a regime shift:

- Up to then, security is co-financed by issuance.
- Beyond that point, everything depends on the fee market.

If fees do not reach a sufficient level:

- miners switch off their equipment,
- hashrate declines,
- the cost of attacking the network drops,
- and the probability of deep reorganizations, censorship, or double spending rises.

In such a scenario, the asset loses its basic function as a store of value: a vulnerable network cannot guarantee the immutability or security of balances.

This risk translates, in valuation terms, into a non-zero probability that Bitcoin's value will be practically zero in the long run.

4. A Simple Valuation Model with Collapse Probability

4.1 State Structure

Consider a sufficiently long horizon T (for example, roughly aligned with the 2140 timeframe). We define two possible states for Bitcoin:

- State S (functional survival): the network remains secure, hashrate is sufficient, and the asset continues to be accepted. In this state, the value of one bitcoin at T is $V_S > 0$.
- State C (collapse): the network fails to maintain its security (due to lack of incentives or abandonment), and the asset loses virtually all of its value. In this state, the value is 0 or close to zero.

Let:

- $p = P(\text{collapse at } T) = P(C)$,
- $1 - p = P(\text{survival at } T) = P(S)$.

Then the random value at time T is:

$V_T = V_S$ with probability $1 - p$,
 $V_T = 0$ with probability p .

The expectation of V_T is:

$$E[V_T] = (1 - p) \cdot V_S.$$

4.2 Present Value of a Non-Productive Asset Under This Scheme

Since Bitcoin does not generate intermediate cash flows C_t , the price today is:

$$P_0 = E[V_T / (1 + r)^T] = (1 - p) \cdot V_S / (1 + r)^T,$$

where r is a discount rate that includes the appropriate risk premium for this asset (high, given its volatility).

This expression captures two effects:

1. Collapse risk: the factor $(1 - p)$ reduces the expectation of V_T .
2. Time discounting: the factor $(1 + r)^T$ pushes down the present value the more distant the horizon is.

4.3 Interpretation for a Safe-Haven Asset

For an asset to be considered a safe haven in a strict sense, the probability of collapse should be virtually zero:

$$p \approx 0 \Rightarrow E[V_T] \approx V_S.$$

In that case, the present value is approximately:

$$P_0 \approx V_S / (1 + r)^T,$$

and the discussion concerns how value is discounted over time, not whether the asset might disappear.

In Bitcoin's case, however:

- the incentive design beyond 2140 does not offer any solid guarantee of network security;
- therefore, it is reasonable to assign a structural, not merely speculative, $p > 0$.

Even if V_S were very high, the product $(1 - p) \cdot V_S$ incorporates the possibility of a terminal value of zero. For a safe-haven asset, the critical point is not whether the present value is literally zero, but that the mere existence of a non-negligible structural probability of future annihilation is incompatible with the safe-haven function.

5. Feedback Between Collapse Probability, Discount Rate, and Volatility

In the previous analysis, long-term collapse risk was captured by the parameter p , and the discount rate r was treated as exogenous. In a real market like Bitcoin's, these two elements are not independent:

- the perceived probability of collapse (p) influences the discount rate demanded by investors (r);
- price volatility (σ) feeds that risk perception and is, at the same time, a consequence of it.

This generates a mechanism of unstable feedback which reinforces the idea that risk is not only theoretical but also empirical and observable through the asset's high historical volatility.

5.1 From Collapse Probability to Discount Rate

The valuation expression:

$$P_0 = (1 - p) \cdot VS / (1 + r)^T$$

can be refined by decomposing the discount rate:

$$r = r_f + \pi(p, \sigma),$$

where:

- r_f : risk-free rate,
- $\pi(\cdot)$: risk premium, an increasing function of:
- p : perceived long-term collapse probability,
- σ : observed short- and medium-term price volatility,

with $\partial\pi/\partial p > 0$ and $\partial\pi/\partial\sigma > 0$.

Substituting into the valuation formula:

$$P_0 = (1 - p) \cdot VS / (1 + r_f + \pi(p, \sigma))^T.$$

An increase in p therefore has a double negative effect on price:

1. It directly reduces the numerator via $(1 - p)$.
2. It indirectly increases the denominator via $\pi(p, \sigma)$, and thus r .

In other words, collapse risk not only cuts the expected value but also raises the rate at which it is discounted.

5.2 Volatility as an Empirical Manifestation of Structural Risk

Historically, Bitcoin exhibits a volatility σ that is much higher than that of assets considered safe havens (gold, top-quality sovereign debt). This volatility is not a purely speculative phenomenon; it can be interpreted as reflecting:

- the absence of stabilizing cash flows,
- dependence on a narrative of future adoption,
- extreme sensitivity to news on regulation, security, forks, etc.,
- and, on the longer horizon, uncertainty about the sustainability of the network once the subsidy ends.

In this context:

- An increase in perceived p (probability of future collapse) leads to

selling pressure,

- which increases volatility σ ,
- and higher σ in turn feeds back into the risk premium $\pi(p, \sigma)$,
- further raising the discount rate r and reducing the equilibrium price P_0 .

We thus obtain a loop:

$$p \uparrow \Rightarrow P_0 \downarrow \Rightarrow \sigma \uparrow \Rightarrow \pi(p, \sigma) \uparrow \Rightarrow r \uparrow \Rightarrow P_0 \downarrow.$$

The collapse does not need to actually occur for the asset to stop behaving like a safe haven: it is enough for the market to repeatedly incorporate this structural risk in the form of high volatility and elevated risk premia.

5.3 Instability Versus the Stability Required of a Safe Haven

A safe-haven asset is not defined only by its expected value, but by its risk profile:

- low volatility,
- low sensitivity to news or speculative cycles,
- low perceived probability of annihilation.

In the framework above, a genuine safe haven would be characterized by:

- $p \approx 0$,
- moderate σ ,
- low and relatively stable $\pi(p, \sigma)$,
- r close to r_f ,
- and a P_0 that is less sensitive to changes in narrative or episodes of stress.

Bitcoin sits at the opposite extreme:

- structural $p > 0$ by design (post-2140 uncertainty),
- empirically high σ ,
- thick and unstable $\pi(p, \sigma)$,
- high and endogenously unstable r ,
- extremely sensitive P_0 to expectation revisions.

The market dynamics themselves thus reinforce the theoretical diagnosis: collapse risk is not just an abstract parameter in a model; it manifests as high volatility and elevated risk premia. This feedback between p , σ , and r solidifies the fact that Bitcoin behaves like a high-risk speculative asset, not a stable safe haven.

6. Implications for the "Digital Gold" Narrative

The comparison between Bitcoin and gold is usually based on scarcity and the difficulty of increasing supply. However, from a safe-haven perspective:

- Physical gold is not subject to an incentive design that can fail in 2140; its existence does not depend on the economic functioning of a specific network.
- Bitcoin, by contrast, does depend on the presence of a sufficiently large set of miners incentivized to secure the chain.

The core argument of this paper can be summarized as follows:

1. Bitcoin is an asset whose present value is based solely on its future resale value.
2. That future value depends critically on network security.
3. Network security, after the subsidy disappears, depends on a fee market whose level and stability are uncertain.
4. That uncertainty introduces a non-zero probability that, over a long horizon, the asset will lose virtually all of its value.
5. The perception of this risk manifests as high volatility and endogenously elevated risk premia, which further reinforce the asset's non-safe-haven character.

Consequently, although Bitcoin may be a speculative asset or a high-beta instrument relative to certain macro narratives, its classification as a safe-haven asset is not supported either by intertemporal valuation or by the empirical observation of its behaviour.

7. Likely Objections and Replies

7.1 "Fees Will Rise and Sustain the Hashrate"

This argument assumes that:

- network usage will be sufficiently intense,
- users will be willing to pay very high fees,
- and those fees will not push usage away to other layers or chains.

In practice, exceptionally high on-chain fees can reduce on-chain volume and shift activity to alternative solutions, thereby reducing the very revenue base for miners. There is, therefore, no guarantee that the fee equilibrium will be sufficient and stable.

7.2 "Even if There Is Risk, It Is Still Better Than Fiat"

Comparison with fiat currencies introduces other risks (inflation, discretionary policies), but for the safe-haven category what matters is:

- whether long-term collapse risk is almost zero (gold, land),
- or whether the asset can, in principle, disappear as a functional system.

By design, Bitcoin belongs to the second group: its value depends on the continuity of a specific network and a specific set of economic incentives. The existence of a structural $p > 0$, amplified by high observed volatility, is incompatible with the idea of a robust safe

haven.

8. Conclusion

This paper has developed a simple but structurally strong argument:

1. Bitcoin is a non-productive asset whose present value depends exclusively on its expected terminal value.
2. Bitcoin's design introduces an economic regime shift around 2140, when the block subsidy disappears.
3. Beyond that point, network security depends on a fee market with no guarantee of sufficiency or stability, which introduces a non-negligible structural probability of long-term network collapse ($p > 0$).
4. Incorporating this probability into a standard discounted-cash-flow framework implies that, even if the current price may be high, Bitcoin does not satisfy the intertemporal requirements of a safe-haven asset, which demands virtually no risk of future annihilation.
5. Feedback between perceived collapse probability, volatility, and risk premium exacerbates the asset's instability, empirically reinforcing its speculative nature and pushing it even further away from the profile of a stable refuge.

In short, Bitcoin's fundamental weakness does not lie in its programmed scarcity, but in the lack of a robust and guaranteed mechanism to sustain network security beyond 2140, and in the unstable dynamics this generates in terms of risk and discounting. As long as this uncertainty persists, the label of "safe-haven asset" applied to Bitcoin is, from both a theoretical and empirical standpoint, unsustainable.